TITLE: CHOCOLATE CRUMB

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CHOCOLATE CRUMB

FIELD OF THE INVENTION

The present invention relates to a chocolate crumb, to a method for its preparation, and to milk chocolate prepared from the chocolate crumb.

BACKGROUND OF THE INVENTION

Milk chocolate differs from dark or plain chocolate in that it contains milk solids and the essential part of the milk chocolate process is the method used to incorporate the milk solids. Milk chocolate is virtually moisture-free and contains from 0.5-1.5% water while full cream milk contains about 12.5% milk solids including fat, the remainder being about 87.5% water.

One method of removing the 87.5% water from the milk is by evaporation of the liquid milk and drying to a powder and a traditional method of producing milk chocolate is by mixing milk powder together with cocoa liquor or cocoa nibs, sugar, and cocoa butter, followed by refining, conching and tempering.

Another method of removing the 87.5% water from the milk is by condensing and drying a mixture comprising either liquid milk or milk concentrate together with sugar and cocoa liquor under vacuum and at elevated temperatures to produce a chocolate crumb powder. This process for making chocolate crumb was originally intended to preserve milk solids in a stable form over long periods of time and the chocolate crumb is used as an intermediary product in another traditional method of production of milk chocolate which comprises mixing chocolate crumb with cocoa butter, followed by refining, conching and tempering.

One advantage of chocolate crumb powder is that it has excellent storage properties and prevents rancidity of the fats in the milk. This enables the chocolate crumb to be manufactured well in advance of the manufacture of the milk chocolate and can easily be transported to any desired destination. In addition, the use of chocolate crumb instead of milk powder provides a rich, creamy partially caramelised flavour which has proved extremely desirable to a large number of consumers. Although milk is sometimes transported to chocolate factories where the crumb is produced, since milk soon turns sour, it

is preferable to install the crumb factories in dairy farming rural regions where there is a steady supply of fresh liquid milk. Often the crumb factories are in chocolate factories in dairy regions.

It would be convenient to manufacture crumb type chocolates in regions where it has not previously been feasible and attempts have been made to imitate the flavour produced by the crumb process using standard milk powders. However, none of these methods has yet produced an adequate substitute.

For example, GB-B-1425839 claims a method of manufacturing a milk chocolate, comprising the steps of melting sugar by heating it to a temperature of between 188° and 210°C, mixing the heated, molten sugar with milk powder, and processing the mixture with other chocolate making ingredients to form a milk chocolate. However, molten sugar is difficult to handle and requires a high energy input, amorphous sugar may be formed together with a high viscosity which could influence the texture and lead to non-desirable flavours at the high temperature used.

USP3622342 describes a method for preparing chocolate crumb from milk solids by dry blending the milk solids with sugar and cocoa liquor and then extrusion cooking the mixture in the presence of a little water at a temperature from about 104° to 127°C for a period of from about 1-3 seconds followed by cooling and comminuting. The chocolate crumb may be used to produce milk chocolate by conventional methods. However, the capital cost of the extruder is very high and the process reaction time is very short which may inherently limit the range of flavours.

GB-A-1,537,377 describes a method of making a milk chocolate in which a mixture based on milk and sugar is prepared and then dried under reduced pressure to form a product of the crumb type which is compressed under a pressure of at least 100kg/cm^2 and subsequently processed into milk chocolate. However, the process is only concerned with the production of white crumb, the vacuum/evaporation process is carried out at a temperature of only about 80°C, and at such a low temperature there will be little or no caramelisation and a restricted flavour.

DE3502446 describes a method for the preparation of chocolate crumb which comprises mixing milk powder and icing sugar and water at about 80°C and

then adding cocoa paste and heat to about 100° to 110°C in a slowly revolving mixer (the water and heat being introduced in the form of steam through nozzles), followed by drying. However, the use of icing sugar is more expensive than ordinary sugar and gives a different texture. In addition, icing sugar causes the formation of large lumps which can increase the viscosity and cause blockages. DE3502446 gives no indication of the reaction time nor the quantities of ingredients used, except the water.

SUMMARY OF THE INVENTION

We have found that by reacting milk solids, sugar, cocoa liquor and from 1.2 to 8% total water content in a mixer at a temperature of 85° to 180°C for a period of from 2.5 to 25 minutes followed by drying to a moisture content of less than 3%, not only is an excellent chocolate crumb obtained but also the flavour can be tailored to requirements by adjusting the temperature, time and water content.

Accordingly, the present invention provides a process for the preparation of chocolate crumb which comprises mixing and heating milk solids, sugar, in the absence or presence of cocoa solids and from 1.2 to 8% by weight of water based on the weight of the mixture in a mixer to a temperature of 85° to 120°C, reacting at a temperature of 85° to 180°C for a period of from 2.5 to 25 minutes followed by drying to a moisture content of less than 3% by weight based on the total weight of the mixture.

DETAILED DESCRIPTION OF THE INVENTION

The milk solids may comprise, for example, whole milk powder, whey proteins or low fat milk solids. The low fat milk solids preferably contain less than 5% by weight of fats, more preferably less than 2% by weight of fats and is most preferably skimmed milk powder, or ingredients thereof or recombined dairy solids. The amount of milk solids may be from 20 to 70% and preferably from 25 to 65% by weight based on the total weight of the mixture.

The sugar used is preferably in the form of a dry powder which may be crystalline or in the form of a slurry. The sugar used may be, for example, sucrose, glucose, dextrose, lactose, fructose, invert sugar, corn syrup solids or sugar replacers such as polyols, e.g. sorbitol, mannitol, xylitol, maltitol. lactitol,

polydextrose, etc., or mixtures thereof. Preferably, the sugar used is sucrose alone but, if desired, one or more other sugars may be used together with sucrose in an amount up to 25% by weight based on the total weight of the sugar, e.g. from 5 to 20% by weight based on the total weight of the sugar. If desired, a part of the sugar or sugar replacer may be replaced by a low calorie sweetening agent such as a cyclamate, aspartame or nutrasweet. The amount of sugar used may be from 10 to 75% and preferably from 20 to 70% by weight based on the total weight of the mixture.

In conventional processes of producing chocolate crumb, the ratio of milk solids to sugar is conventionally from about 1:3 to 1:1.5 and such ratios may be used in the present invention, more usually from 1:2.5 to 1:1.75. However, in the process of the present invention, it is possible to produce a concentrated chocolate crumb by reducing the amount of sugar used in order to improve the processing and increase the production capacity. In this case, the ratio of milk solids to sugar may be between 1:1.5 and 1: 0.1, preferably from 1:1.25 to 1:0.3 and especially from 1:1 to 1:0.75.

When the process is carried out in the absence of cocoa solids, a white crumb is obtained. When the process is carried out in the presence of cocoa solids, the cocoa solids may be in the form of cocoa liquor, cocoa powder or cocoa butter alternatives which are vegetable fats such as cocoa butter equivalents (CBE) or cocoa butter substitutes (CBS) which are well known to those skilled in the art, e.g. CBS laurics and CBS nonlaurics (see Chocolate, Cocoa, and Confectionery; Third Edition, 1989, Bernard W. Minifie; AVI), pp100-109. The cocoa liquor may be conventional cocoa liquor produced by roasting cocoa beans, cooling, winnowing to form the nibs and grinding the nibs to form the liquor containing from about 50 to 60% cocoa butter. The cocoa powder may be obtained by extracting the cocoa butter from the cocoa liquor by conventional methods. The amount of cocoa solids used in the process of the present invention may be from 3 to 20% by weight based on the total weight of the mixture. The amount of cocoa solids generally used in the concentrated chocolate crumb of the present invention may be from 5 to 15% by weight based on the total weight of the mixture.

It should be understood that the expression "chocolate crumb" used in this invention is intended to include crumb which may be used for making compound coating or substitute chocolate where some or all of the cocoa solids

are replaced by cocoa butter alternatives, or which contain sugar replacers or ingredients such as carob or soya protein isolates. Compound coatings are well known to those skilled in the art (see Chocolate, Cocoa, and Confectionery; Third Edition, 1989, Bernard W. Minifie: AVI), pp165-182).

The present invention also provides a concentrated chocolate crumb comprising low fat milk solids, sugar and optionally cocoa solids wherein the ratio of milk solids to sugar is between 1:1.5 and 1: 0.1, preferably between 1:1.25 and 1:0.3. When cocoa solids are present, preferably the amount of cocoa solids in the concentrated chocolate crumb is from 10 to 15% by weight based on the total weight of the mixture.

The amount of water used in the process of the present invention is preferably from 1.5 to 7.5% and more preferably from 1.75 to 6.5% by weight based on the total weight of the mixture.

The mixer may be a low or high shear mixer, e.g. a Lödige high shear mixer (Batch mixer FKM 600D- Morton Machines Ltd) having three ploughs fitted on the main shaft and two high-speed chopper blades. The speed of a low shear mixer is usually from 50 to 100rpm while that of a high shear mixer is usually from 1000 to 3000rpm. Speeds between 100 and 1000rpm are also suitable in the process of this invention.

The mixing of the ingredients preferably provides a homogeneous mass and the time required to raise the temperature to from 85° to 120°C may be from 30 to 150 minutes, preferably from 60 to 120 minutes. The reaction time of the mixture at from 85° to 180°C is preferably from 5 to 20 minutes. The reaction temperature is preferably from 90° to 120°C. After the reaction, the drying temperature may be from 60° to 80°C and preferably from 65° to 75°C. The duration of the drying may be from 30 to 150 minutes and preferably from 60 to 120 minutes. The drying may, if desired, be carried out under vacuum and if a vacuum process is used the drying time is advantageously from 30 to 60 minutes. During drying, the moisture content is preferably reduced to below 2% and more preferably to below 1% by weight based on the total weight of the mixture.

The present invention also provides a method of making a milk chocolate which comprises mixing a chocolate crumb prepared by a process of the

present invention with the remainder of the chocolate ingredients (cocoa liquor, cocoa butter and butter oil) and processing into milk chocolate. The chocolate crumb may be mixed with the remainder of the chocolate ingredients, conveniently in the same mixer as used for making the crumb, and the mixture may then be refined by means of refining rollers, conched and then tempered.

The flavour of the milk chocolate can be varied according to requirements as desired by varying the reaction time, the reaction temperature and the water content during the reaction. Generally, the longer the reaction time, the higher the reaction temperature and the greater the water content, the more intense and complex are the flavours obtained.

For example, using a crumb containing a conventional ratio of milk solids to sugar of from 1:3 to 1: 1.5, the following flavour changes of the milk chocolate are obtained:
a) Increase of the reaction time between 5 and 25 minutes gives an increase of stale flavour.
b) Increase of the reaction temperature gives an increase of cocoa and milk smell, an increase of caramel and fruity flavour and a decrease of astringency and malt flavour.
c) Increase of the initial water content gives a decrease of cocoa flavour and an increase in caramel and butter flavour.

On the other hand, using a concentrated crumb containing a ratio of milk solids to sugar between 1:1.5 and 1:0.1, the following flavour changes of the milk chocolate are obtained:
a) Increase of the reaction time between 5 and 25 minutes gives a decrease in milk flavour and an increase in cocoa and malt flavour.
b) Increase of the reaction temperature gives an increase of stale flavour, sweetness, and bitterness and an increase of caramel flavour.
c) Increase of the initial water content gives an increase of nutty flavour.

To summarise the above data generally, for all the crumbs prepared according to the process of the present invention, the longer the reaction time, the higher the reaction temperature and the greater the specific range of the water content of the initial mix, the more intense and complex are the flavours obtained in the milk chocolates produced from them. The milk chocolates prepared from a concentrated crumb are more astringent and creamier than the milk chocolates

prepared from a crumb containing a conventional ratio of milk solids to sugar of from 1:3 to 1: 1.5.

EXAMPLES

The following Examples further illustrate the present invention.

Example 1

40.95kg of skimmed milk powder, 97.35kg of sucrose and 11.7kg cocoa liquor together with 3kg (2%) water are fed in to the top of a Lödige high-shear mixer (Batch mixer FKM 600D) fitted with a water jacket, thermostatic probe, fan, three ploughs fitted to the main shaft running along the main mixer body wherein the distance between the surface of the ploughs and the mixer inner surface is 5-10mm, two high-speed chopper blades, and an aspiration faciiity enabling rapid removal of moisture from the mix.
(To a total moisture content of around 3.5 %)

The ingredients are mixed and heated to 90°C over a period of 90 minutes, reacted at 90°C for 15 minutes using the high-shear chopper blades and then dried at 70°C for 90 minutes with the fan turned on to reduce the moisture content to below 1% resulting in a crumb containing 64.9% sucrose, 27.3% milk solids and 7.8% cocoa liquor. Milk chocolate is prepared by adding to this crumb (70.55%), cocoa liquor (9.22%), cocoa butter (13.69%), butter oil (6.54%), vanillin crystals (0.04%), mixing for 5 minutes to form a homogeneous mass, passing through 2-roll and 5-roll refiners to give an average particle size of from 20-40 micrometres, followed by conching with the addition of 1.2% of a mix of lecithin and cocoa butter, tempering and moulding by conventional methods. The milk chocolate produced has a caramel, milky, sweet crumb flavour.

Example 2

The procedure of Example 1 is repeated except that 6kg (4%) water is added instead of 3kg there used. The milk chocolate produced has a stronger caramel, biscuit crumb flavour.

Example 3

A concentrated crumb is produced having a milk solids to sugar ratio of about 1:0.9 by a similar process to that described in Example 1 but using 67.07kg of skimmed milk powder, 63.78kg of sucrose and 19.16kg cocoa liquor together with 3kg (2%) water. (To a total moisture content of around 7 %)

The ingredients are mixed and heated to 90°C over a period of 90 minutes, reacted at 90°C for 15 minutes using the high-shear chopper blades and then dried at 70°C for 90 minutes with the fan turned on to reduce the moisture content to below 1% resulting in a crumb containing 42.52% sucrose, 44.71% milk solids and 12.77% cocoa liquor. Milk chocolate is prepared by adding to this crumb (43.08%), sugar (27.47%), cocoa liquor (9.22%), cocoa butter (13.69%), butter oil (6.54%), vanillin crystals (0.04%), mixing for 5 minutes to form a homogeneous mass, passing through 2-roll and 5-roll refiners to give an average particle size of from 20-40 micrometres, followed by conching with the addition of 1.2% of a mix of lecithin and cocoa butter, tempering and moulding by conventional methods. The milk chocolate produced has a caramel crumb flavour which is more astringent and creamier than that of Example 1.

Example 4

A concentrated crumb is produced having a milk solids to sugar ratio of about 1:0.33 by a similar process to that described in Example 1 but using 98.14kg of skimmed milk powder, 32.71kg of sucrose and 19.15kg cocoa liquor together with 9kg (6%) water. The ingredients are mixed and heated to 90°C over a period of 90 minutes, reacted at 90°C for 15 minutes using the high-shear chopper blades and then dried at 70°C for 90 minutes with the fan turned on to reduce the moisture content to below 1% resulting in a crumb containing 42.52% sucrose, 44.71% milk solids and 12.77% cocoa liquor. Milk chocolate is prepared by adding to this crumb the other ingredients of chocolate in a similar procedure to that described in Example 3. The milk chocolate produced has a caramel crumb flavour which is more astringent and creamier than that of Example 1.